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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/762,985
Filing Date: May 08, 2001
Appellant(s): BECKER ET AL.

Gerald A. Messina
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 04/07/08 appealing from the Office action mailed 08/23/06.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

US 5,662,819	KADOMURA	09-1997
US 6,217,785	COLLINS ET AL.	04-2001
US 6,020,794	WILBUR	02-2000
US 5,997,687	KOSHIMIZU	12-1999
WO 97/14177	SAVAS	04-1997
US 5,935,373	KOSHIMIZU	08-1999

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 42-45 and 47-71 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed,

had possession of the claimed invention. The specification, as originally filed, fails to provide support for the limitation "without measuring the ratio of magnitudes of applied and reflected power of the generator" as required by the newly amended independent claim 42. Nothing in the specification would reasonably convey to one skilled in the art that the claimed measurement steps are not performed.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 74 is rejected under 35 USC 103(a) as being as obvious over Kadomura, U.S. Patent 5,662,819 in view of Collins et al., U.S. Patent 6,217,785, Wilbur, U.S. Patent 6,020,794, and Koshimizu, U.S. Patent 5,997,687.

Kadomura shows the invention as claimed including a method for etching a silicon body substrate using an inductively coupled plasma comprising an ICP source 52 for generating a radio-frequency electromagnetic alternating field, a reactor (51,57) for generating the inductively coupled plasma from reactive particles by the action of the radio-frequency electromagnetic alternating field on a reactive gas, and a first means for generating plasma power pulses (see abstract) to be injected into the inductively coupled plasma by the ICP source, the method comprising the step of injecting a pulsed radio-frequency power into the inductively coupled plasma as a pulsed plasma power (see figs. 4-6 and their description).

Kadomura fails to expressly disclose matching an impedance of one of an inductive coupled plasma and the ICP source to an ICP coil generator. Collins et al. discloses utilizing a matching circuit 34 to match the impedance of the ICP coil generator 30 with the ICP source 20 (see col. 3-lines 1-18). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Kadomura so as to match the impedance of the ICP coil generator with the ICP source as suggested by Collins et al. because this will maximize the efficiency of power coupling to the ICP source.

Concerning the oscillator feedback loop being a Meissner oscillator, apparatus limitations, unless they affect the process in a manipulative sense, may have little

weight in process claims. *In re Tarczy-Hornoch* 158 USPQ 141, 150 (CCPA 1968); *In re Edwards* 128 USPQ 387 (CCPA 1961); *Stalego v. Heymes* 120 USPQ 473, 478 (CCPA 1959); *Ex parte Hart* 117 USPQ 193 (PO BdPatApp 1957); *In re Freeman* 44 USPQ 116 (CCPA 1940); *In re Sweeney* 72 USPQ 501 CCPA 1947).

Kadomura and Collins et al. do not expressly disclose wherein the ICP coil generator causes a variation of the frequency of the radio-frequency electromagnetic alternating field so that the impedance is matched as a function of the pulsed plasma power to be injected, so as to provide rapid switching between the plasma power pulses and interpulse periods, wherein the variation of the frequency is automatically performed by an osciallator feedback loop between the ICP coil and the ICP coil generator. Wilbur discloses wherein the ICP coil generator 13 causes a variation of the frequency of the radio-frequency alternating field so that the impedance within the plasma chamber is matched by an oscillator feedback loop (see reference number 20) between the ICP coil and the ICP coil generator (see abstract and fig. 1 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Kadomura modified by Collins et al. so as to perform the impedance matching of Wilbur because this will improve the power efficiency of the plasma apparatus.

Kadomura, Collins et al. and Wilbur are applied as above but fail to expressly disclose wherein the pulsing of the radio-frequency power is accompanied by a change of the frequency of the injected radio-frequency power, the frequency change being controlled in such a way that the plasma power injected into the inductively coupled

plasma during the pulsing is maximized. Koshimizu discloses shifting the frequency higher during pulse plasma processing to enhance the ignition of the plasma (see abstract). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Kadomura modified by Collins et al. and Wilbur so as to shift the frequency of the pulses higher as suggested by Koshimizu in order to improve the ignition of the plasma.

Furthermore, note that the apparatus of Kadomura modified by Collins et al., Wilbur, and Koshimizu will avoid high reflected powers back into the ICP coil generator when the plasma power is pulsed.

Claim 74 is rejected under 35 USC 103(a) as being unpatentable over Savas, WO 97/14177 in view of Collins et al., U.S. Patent 6,217,785, Wilbur, U.S. Patent 6,020,794, and Koshimizu, U.S. Patent 5,997,687.

Savas shows the invention as claimed including a method for etching a silicon body substrate using an inductively coupled plasma comprising an ICP source (150a, 150b) for generating a radio-frequency electromagnetic alternating field, a reactor 100 for generating the inductively coupled plasma from reactive particles by the action of the radio-frequency electromagnetic alternating field on a reactive gas, and a first means for generating plasma power pulses to be injected into the inductively coupled plasma by the ICP source, the method comprising the step of injecting a pulsed radio-frequency power into the inductively coupled plasma as a pulsed plasma power (see fig. 1 and page 6, line 10 to page 13, line 19).

Savas does not expressly disclose matching an impedance of one of an inductive coupled plasma and the ICP source to an ICP coil generator. Collins et al. discloses utilizing a matching circuit 34 to match the impedance of the ICP coil generator 30 with the ICP source 20 (see col. 3-lines 1-18). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Savas so as to match the impedance of the ICP coil generator with the ICP source as suggested by Collins et al. because this will maximize the efficiency of power coupling to the ICP source.

Savas and Collins et al. do not expressly disclose wherein the ICP coil generator causes a variation of the frequency of the radio-frequency electromagnetic alternating field so that the impedance is matched as a function of the pulsed plasma power to be injected, so as to provide rapid switching between the plasma power pulses and interpulse periods. Wilbur discloses wherein the ICP coil generator 13 causes a variation of the frequency of the radio-frequency alternating field so that the impedance within the plasma chamber is matched by an oscillator feedback loop (see reference number 20) between the ICP coil and the ICP coil generator (see abstract and fig. 1 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Savas modified by Collins et al. so as to perform the impedance matching of Wilbur because this will improve the power efficiency of the plasma apparatus.

Savas, Collins et al. and Wilbur are applied as above but fail to expressly disclose wherein the pulsing of the radio-frequency power is accompanied by a change

of the frequency of the injected radio-frequency power, the frequency change being controlled in such a way that the plasma power injected into the inductively coupled plasma during the pulsing is maximized. Koshimizu discloses shifting the frequency higher during pulse plasma processing to enhance the ignition of the plasma (see abstract). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Savas modified by Collins et al. and Wilbur so as to shift the frequency of the pulses higher as suggested by Koshimizu in order to improve the ignition of the plasma.

Concerning the oscillator feedback loop being a Meissner oscillator, apparatus limitations, unless they affect the process in a manipulative sense, may have little weight in process claims. *In re Tarczy-Hornoch* 158 USPQ 141, 150 (CCPA 1968); *In re Edwards* 128 USPQ 387 (CCPA 1961); *Stalego v. Heymes* 120 USPQ 473, 478 (CCPA 1959); *Ex parte Hart* 117 USPQ 193 (PO BdPatApp 1957); *In re Freeman* 44 USPQ 116 (CCPA 1940); *In re Sweeney* 72 USPQ 501 CCPA 1947).

Furthermore, note that the apparatus of Savas modified by Collins et al., Wilbur, and Koshimizu will avoid high reflected powers back into the ICP coil generator when the plasma power is pulsed.

Claim 74 is rejected under 35 USC 103(a) as being unpatentable over Koshimizu, U.S. Patent 5,935,373 in view of Collins et al., U.S. Patent 6,217,785, Wilbur, U.S. Patent 6,020,794, and Koshimizu, U.S. Patent 5,997,687.

Koshimizu '373 shows the invention as claimed including a method for etching a silicon body substrate using an inductively coupled plasma comprising: an ICP source 118 for generating a radio-frequency electromagnetic alternating field, a reactor 102 for generating the inductively coupled plasma from reactive particles by the action of the radio-frequency electromagnetic alternating field on a reactive gas, and a first means for generating plasma power pulses 154 to be injected into the inductively coupled plasma by the ICP source, the method comprising the step of injecting a pulsed radio-frequency power into the inductively coupled plasma as a pulsed plasma power (see figs. 1-3B and their description).

Koshimizu '373 does not expressly disclose matching an impedance of one of an inductive coupled plasma and the ICP source to an ICP coil generator. Collins et al. discloses utilizing a matching circuit 34 to match the impedence of the ICP coil generator 30 with the ICP source 20 (see col. 3-lines 1-18). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Koshimizu '373 so as to match the impedance of the ICP coil generator with the ICP source as suggested by Collins et al. because this will maximize the efficiency of power coupling to the ICP source.

Koshimizu '373 and Collins et al. are applied as above but fail to expressly disclose wherein the ICP coil generator causes a variation of the frequency of the radio-frequency electromagnetic alternating field so that the impedance is matched as a function of the pulsed plasma power to be injected, so as to provide rapid switching between the plasma power pulses and interpulse periods. Wilbur discloses wherein the

ICP coil generator 13 causes a variation of the frequency of the radio-frequency alternating field so that the impedance within the plasma chamber is matched by an oscillator feedback loop (see reference number 20) between the ICP coil and the ICP coil generator (see abstract and fig. 1 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Koshimizu '373 modified by Collins et al. so as to perform the impedance matching of Wilbur because this will improve the power efficiency of the plasma apparatus.

Koshimizu, '373, Collins et al. and Wilbur are applied as above but fail to expressly disclose wherein the pulsing of the radio-frequency power is accompanied by a change of the frequency of the injected radio-frequency power, the frequency change being controlled in such a way that the plasma power injected into the inductively coupled plasma during the pulsing is maximized. Koshimizu '687 discloses shifting the frequency higher during pulse plasma processing to enhance the ignition of the plasma (see abstract). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Koshimizu '373 modified by Collins et al. and Wilbur so as to shift the frequency of the pulses higher as suggested by Koshimizu '687 in order to improve the ignition of the plasma.

Concerning the oscillator feedback loop being a Meissner oscillator, apparatus limitations, unless they affect the process in a manipulative sense, may have little weight in process claims. *In re Tarczy-Hornoch* 158 USPQ 141, 150 (CCPA 1968); *In re Edwards* 128 USPQ 387 (CCPA 1961); *Stalego v. Heymes* 120 USPQ 473, 478

(CCPA 1959); *Ex parte Hart* 117 USPQ 193 (PO BdPatApp 1957); *In re Freeman* 44 USPQ 116 (CCPA 1940); *In re Sweeney* 72 USPQ 501 CCPA 1947).

Furthermore, note that the apparatus of Koshimizu '373 modified by Collins et al., Wilbur, and Koshimizu will avoid high reflected powers back into the ICP coil generator when the plasma power is pulsed.

(10) Response to Argument

Concerning the rejection of claims 42-45 and 47-71 under 35 USC 112, first paragraph, appellant argues that the examiner has not shown or does not identify why the rejected claims are not supported by the written description of the present application, specifically, why the limitation of ""without measuring the ratio of magnitudes of applied and reflected power of the generator" is not supported by the specification. However, the examiner respectfully submits that a negative limitation must have basis in the original disclosure. For instance, page 14, lines 10-14, of the specification, make clear that both the applied and reflected powers are measured in the instant invention. Additionally, pages 2-6 of the specification referenced by applicant would not lead one of ordinary skill in the art to conclude that the limitation "without measuring the ratio of magnitudes of applied and reflected power of the generator" is supported by the original specification. For these reasons, the rejection under 35 USC 112, first paragraph is respectfully maintained.

Regarding the rejection of claim 74 under 35 USC 103 over Kadomura, U.S. Patent 5,662,819 or Savas, WO 97/14177 or Koshimizu, U.S. Patent 5,935,373 in view

of Collins et al., U.S. Patent 6,217,785, Wilbur, U.S. Patent 6,020,794, and Koshimizu, U.S. Patent 5,997,687, appellant argues that the claim limitation "the variation of the frequency is such as to avoid high reflected powers back into the ICP coil generator when the plasma power is pulsed" is not described or suggested by any of the references. However, the examiner respectfully submits that the Wilbur reference clearly teaches varying the frequency as to avoid high reflected powers back into the RF power generator (see, for example, the abstract and fig. 1 and its description) and that this reference, in combination with the references of Kadomura or Savas or Koshimizu '373 discloses the limitation as claimed. Furthermore, it should be noted that one of ordinary skill in the art, at the time the invention was made, would understand that high reflected powers would be avoided back into the ICP coil generator, as a result from varying the frequency in the process of Kadomura or Savas, or Koshimizu, in view of Collins et al., Wilbur, and Koshimizu.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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